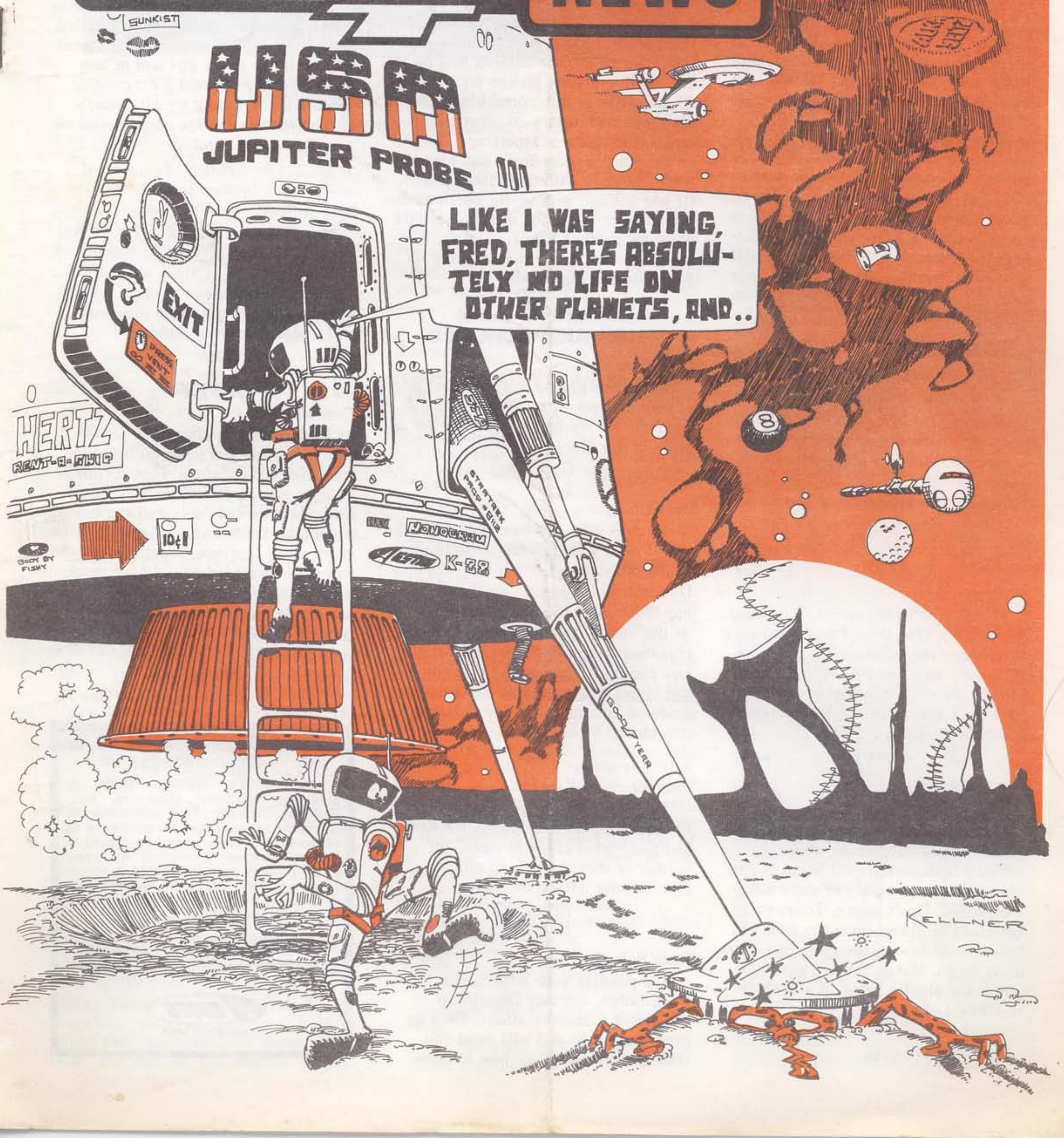
MODEL ROCKET NEWS

Vol. 11, No. 1
January 1971



NOTES FROM THE BOSS

ESTES' rockets were "born" to help those who'd like to build a rocket, do it safely, and have an enjoyable time learning about rockets while they are doing it. A lot of the staff here devotes much time to meet these objectives.

Your letters not only tell us how well we're doing, but also give us a chance to work directly with you to make your rocket activities even more valuable. I'd like to share some recent letters with you. Perhaps, at the same time, this will give you some ideas on how you can get even more from your own rocket activities.

CATALOG COMMENTS

Dear Mr. Estes:

I received my catalog and I was thrilled. For a long time I've been waiting for the moment you would introduce plastic fins and parts. It seemed every time I would turn around a fin would be broken on my rocket.

David L.
Texas

Dear Sir:

Today I received your new catalog in the mail. One thing I was not happy to see was the increased use of plastic nose cones and fins. This seems to take the enjoyment out of building rockets. I know this could help you in production, but . . .

Tony K.
Wisconsin

Dear David & Tony:

We really didn't expect everyone to agree on this subject. However, by offering both plastic and balsa, we're able to meet the needs of many more rocketeers. Don't worry, Tony, we're not about to discontinue the good old balsa methods - unless everyone tells us to do so. David, for you guys who prefer the plastic parts, it's a whole new world of rocketry.

Vern

Dear Sir:

While reading your new catalog, I noticed an error on page 29. The catalog states that the Astron Sprint uses a parachute recovery system when, in fact, this model uses a streamer for recovery.

Melvin L.
Massachusetts

Dear Melvin:

Thanks for letter number 5,627 on this subject. Sorry we didn't catch this error before the catalog was printed. "Will everyone please turn to page 29 and write in this correction." We also received letters on other minor errors, including misspelling "ARCAS" on the sample order form, and about some catalogs with duplicated pages. (If you got one with whole sections duplicated, or a section missing, please write for another.) Well, anyway, it's not as bad as the year we offered an 8-foot launch lug for 15¢!

Vern

CLUBS AND SCHOOLS

Dear Sirs:

Could you please send me four more of your new model rocket catalogs. I need one for my teacher and one for my science fair group.

Danny M.
Texas

Dear Danny:

Enclosed are the catalogs. If you'll have your teacher write (using school stationery) to our Education Director, Bob Cannon, we'll send him (her) some special information on the use of model rocketry in the classroom. Just have him ask for our new booklet, "Aerospace Education and Model Rocketry." It's a complete guide on how to get a class started in rocketry."

Vern

Dear Mr. Vern Estes:

I would like your advice on how to keep a rocket club going. We have had two rocket clubs already, but neither of them lasted. So please give us your advice on clubs.

Robert E.
Kentucky

Dear Robert:

I'm passing your letter along to Dane Boles, our new Director of Rocketeer Communications. He's an expert on clubs and will send you some good pointers on how to make your club activities so exciting you'll soon be beating guys off with a stick. Dane can also let you know the addresses of the nearest club. Glad we could help. Let us know how your club progresses.

Vern

OOPS!

Dear Mr. Estes:

A few weeks ago I wrote a letter to Estes Industries requesting a catalog, but when I sealed the envelope I sealed in a letter to my girl and in turn mailed her the request for a catalog. Thanks for returning my girlfriend's letter. Now, could you please send me a model rocket catalog.

Robert S.
New York

Dear Robert:

Reminds me of the time I got a letter from my best girl which started out, "My darling SAM, I shall always . . . . . ." Oh, well, confusion often results when you try to mix girls with rockets - so I understand your problem.

Vern

SAFETY

Dear Mr. Estes:

I would like to thank you for the safety section you have included in your last two catalogs. I am a college student majoring in Chemistry, and I know what rocket fuels and explosions, especially amateur made, can do. Two years ago I lost two fingers in a chemical explosion. If I would have paid more attention to men like you, I'd have two whole hands today. I appreciate very much what you're trying to do with your program.

Michael C.

(continued on Page 12)

MODEL ROCKET NEWS

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The MODEL ROCKET NEWS is published by Estes Industries, Inc., Penrose, Colorado. This publication is written for America's model rocketeers to promote safe youth rocketry, distribute current technical information and make model rocketry more enjoyable and educational. Current issues of the MRN are distributed free of charge to all active Estes customers.

Vernon Estes------------------------Publisher
Frank Genty------------------------------Editor
Gene Street-------------------Chief Illustrator

ESTES
A SUBSIDIARY OF DAMON

REAR-EJECTION SPRINT FOR ULTIMATE PERFORMANCE

by
Larry Renger
Research and Development Division
Estes Industries

Simple modifications include body cut, heavier nose cone

In contest altitude flying, it is well known that rear ejection systems reduce drag. By eliminating the break between the nose cone and body tube, flow is smoother and more likely to remain laminar along the body tube.

Design Development at Estes R & D Division has removed the nose joint while retaining the total reliability expected of Estes products. The recovery system from Estes Industries Free Plan #40 "Mitosis" proved to be ideal for use on the Astron Sprint.

The article details the modifications necessary to get the ultimate out of your Sprint. The only additional materials required are:

1 nose cone weight (701-NCW-1)

1 tube body putty (651-FM-1)

1 stage coupler (651-JT-50C)

Modifications are as follows:

(1) Proceed with steps 1 through 5 in the instructions.

(2) Do step 7 in the instructions, then cut the body tube into two lengths (as shown on page 64 of the Technical Manual in the Estes catalog), making the rear section 2-1/4". The front section will be 7-1/4".

(3) Install the engine holder into the short rear tube, as per step 6 in the instructions.

(3a) Cut the launch lug (Part #LL-2A) into two 1/4" lengths, as illustrated in step 8 of the instructions. Glue one launch lug 4-1/4" forward from the body break and the other one immediately ahead of the body break.

(4) Smear glue inside the rear body tube ahead of the engine holder. Slide the stage coupler down flush with the top of the engine holder.

(5) Perform step 9 of the instructions, except that the shock cord mount should be glued inside the stage coupler instead of inside the body tube.

(6) Proceed with steps 10 and 11 of the instructions.

(7) In step 12 of the instructions, install the nose weight under the screw eye.

(8) Perform step 13 of the instructions.

(9) Run the shock cord through the body tube, tie it to the screw eye, and then glue the nose cone into the front of the body tube.

(10) Using body putty, fill and smooth out the nose cone and shroud joints until they are completely gone. Body putty is useful for smooth fin fillets, too.

(11) Proceed with steps 14 through 16 of the instructions. For streamer recovery, attach the streamer in the manner specified, but about 3" from the rear body section. If a parachute is to be used, attach it as follows: Fold a tape disc double over the shock cord about 3" from the lower body section. Poke a hole through the disc just beside the cord. Clip the snap swivel around the cord through the hole. (To get reliable chute deployment, pass the last wrap of the shroud lines over the top of the chute as it is inserted in the upper body section).

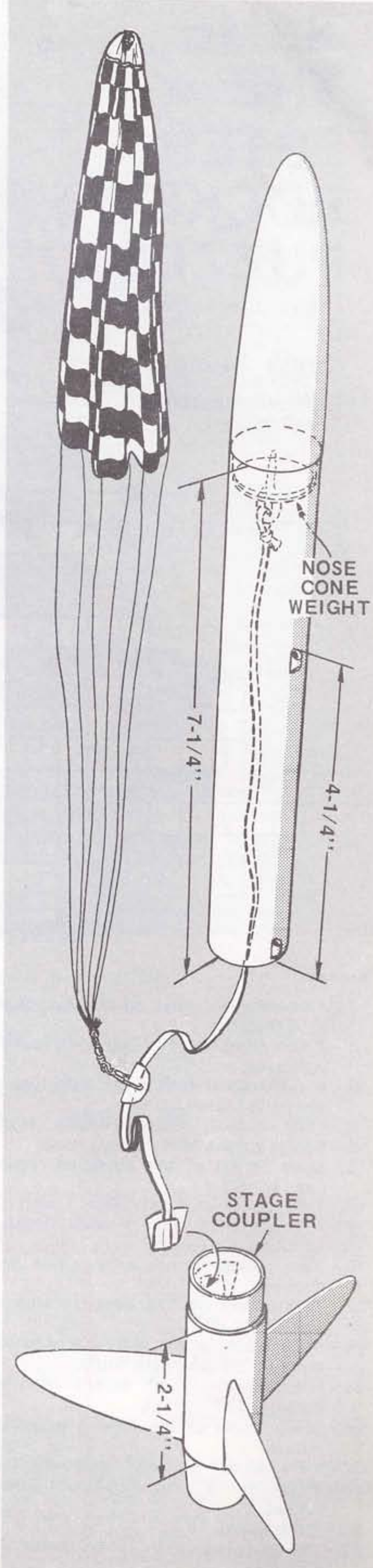
(12) Setup for launching:

(a) Load streamer or chute into forward section.

(b) Load engine per #12 of the Countdown instructions.

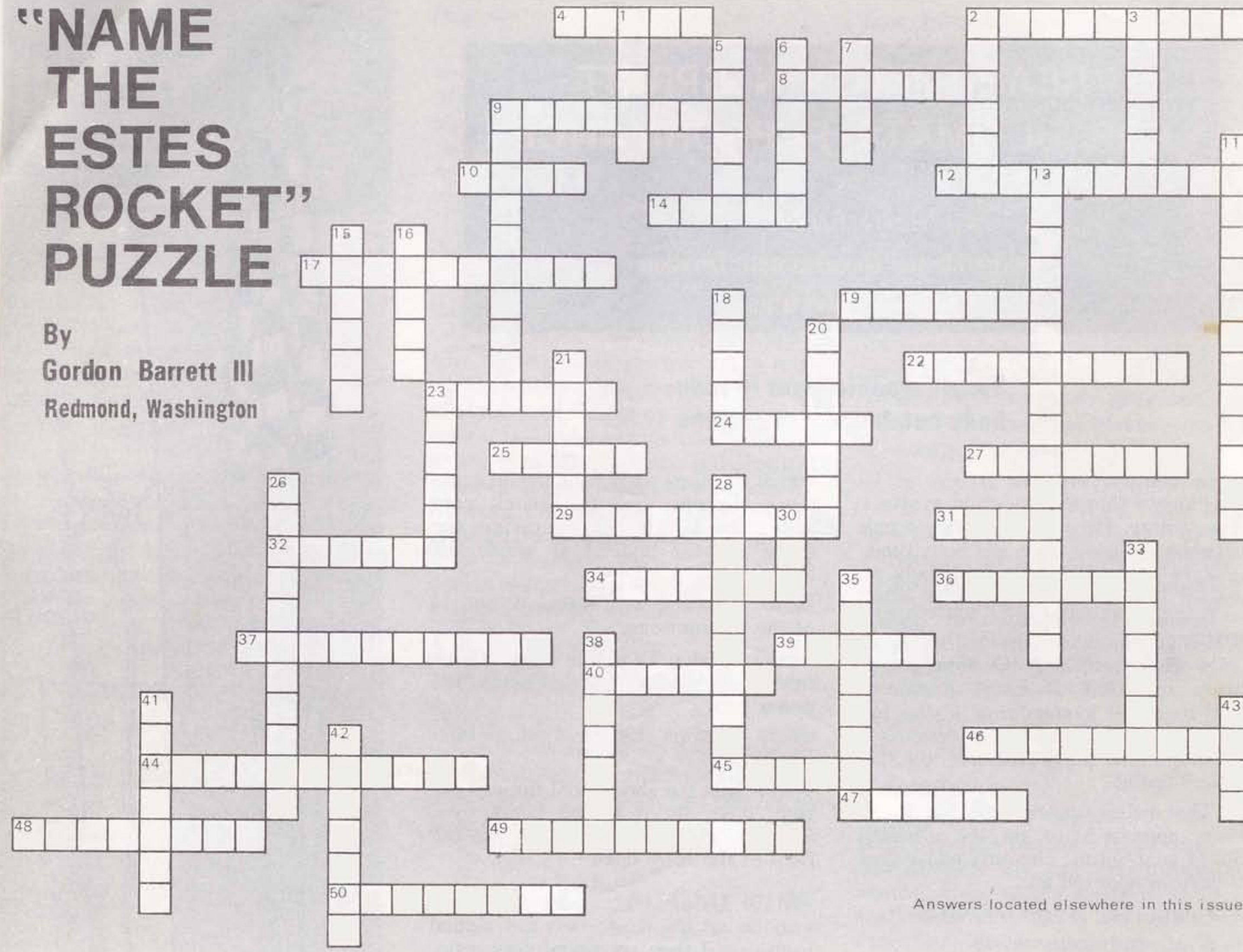
(c) Pack three squares of wadding into the lower body section.

(d) Slide the two body sections together.



"NAME THE ESTES ROCKET" PUZZLE

By
Gordon Barrett III
Redmond, Washington



Answers located elsewhere in this issue.

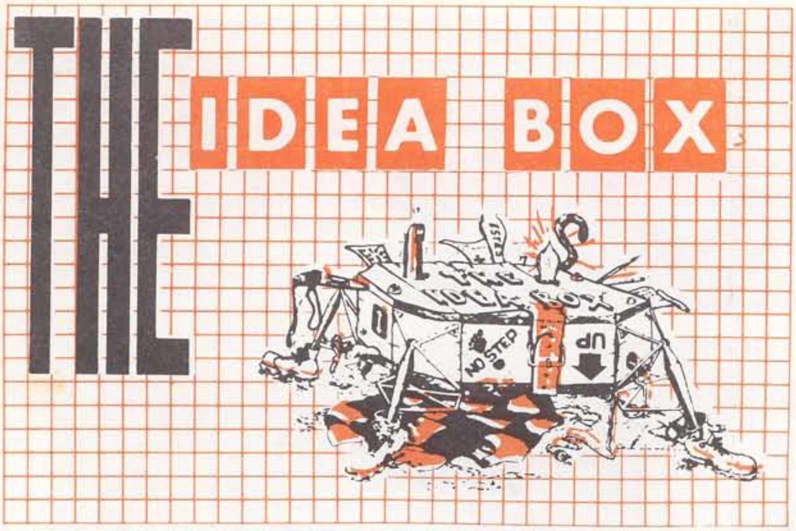
Across

2 - Three-engine, payload rocket, made for EGGS!!!!!
4 - A new two-stage "D" powered rocket by Estes.
8 - A two-stage rocket that looks like a sounding rocket.
9 - This rocket looks like a man.
10 - Fourth planet from our sun (Sol).
12 - Scale model of the sounding rocket used in IGY.
14 - This rocket uses helicopter recovery.
17 - A Boost-Glider with a small payload section.
19 - This rocket introduces ejection gas ducting.
22 - This rocket has the most fin area of any for its size.
23 - This little rocket will easily reach the 2,000' mark in its flight.
24 - Recommended first rocket in your collection.
25 - Scale model of the famous sounding rocket.
27 - This rocket is NOT made to fly.
29 - This is a Pop-Pod-Boost-Glider rocket.
31 - Same as No. 10.
32 - Smallest two-stage rocket made by Estes.
34 - Greatest breakthrough in rocket photography.
36 - This rocket is called the Mars ________.
37 - Rocket used to test the Apollo capsule in suborbital flights.
39 - This rocket was named after a kind of RAY.
40 - Highest point of any rocket's flight.
44 - This rocket is called –H–R –G–N– – –.
45 - A perfect rocket for the Camroc.
46 - This rocket looks like the Ranger but uses one engine.
47 - This one is called Mars ______.
48 - The launch vehicle before the Saturn V.
49 - The Army's Surface-to-Surface Ballistic Missile.
50 - Booster for Alan Shepard's Mercury capsule.

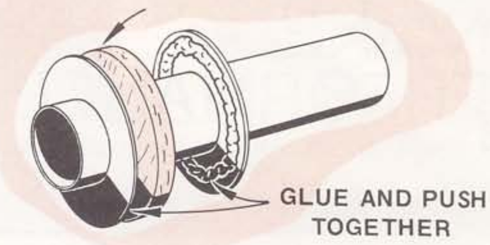
Down

1 - The name of the company where these rockets are built.
2 - The first two-stage rocket with the Pop-and-Go staging.
3 - A little ______ told me about this one.
5 - This rocket looks like the Big Bertha but it uses three engines.
6 - This rocket takes one picture per flight.
7 - A good looking two-stage rocket using series III engines.
9 - It has a forward crew cockpit canopy.
11 - This rocket has landing shocks on its fins and is also a payload rocket.
13 - This rocket is a possible way of inter-planetary travel in the 1980's.
15 - This rocket has a ring around its fins.
16 - This rocket's engine pops 1/2 way out to change the CG.
18 - Name of a snake found in India.
20 - This rocket is called –K–H–O–.
21 - A wonderfully performing Boost-Glider.
23 - This is a new high altitude rocket which will get to 1,600' with a C6-7.
26 - The rocket before Apollo.
28 - The first "D" powered rocket.
30 - The first part of the ––– Corporal.
33 - This rocket is called –RI–TE–.
35 - Its name is a military rank.
38 - The only three-stage rocket by Estes.
41 - The name of the rocket that put man on the moon.
42 - The first manned space program in the U.S.
43 - This rocket comes with streamer in the kit itself.

THE IDEA BOX

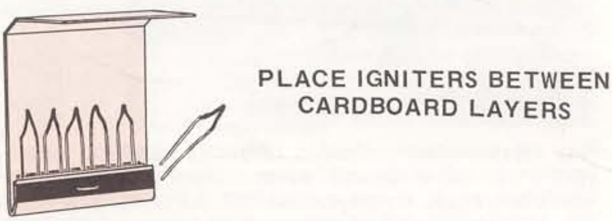


STRONGER ENGINE MOUNTS



John Pauletich of Pueblo, Colo., suggests using a paper centering ring as a template to make a balsa centering ring. This gives extra gluing surface and strength to engine tube mountings in large body tubes.

HANDY IGNITER HOLDER



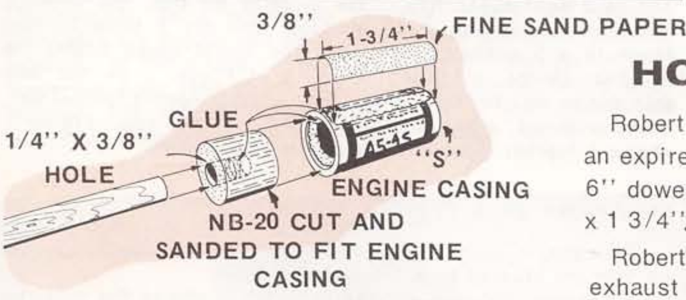
Ever have trouble keeping igniters ready and handy?

Joseph Lozito of Long Island City, N.Y. uses an empty match book to carry his igniters around.

The abrasive portion of the match book can also be used to clean micro-clips.

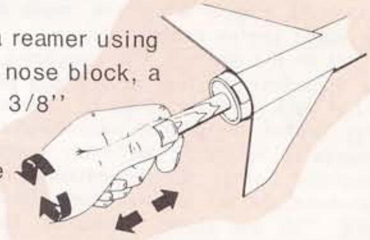
"D" ENGINE AS ADAPTER

Larry DiGioia, Pittsburgh, Pa. and Lee Allen of Williamsport, Ind. are two of many rocketeers who have suggested a use for expended "D" engine casings. Use a sharp knife to clean out the casing and slightly enlarge the nozzle for ejection gases, thus converting your "D" engine casing to an adapter for launching a "D" bird with B or C engines.



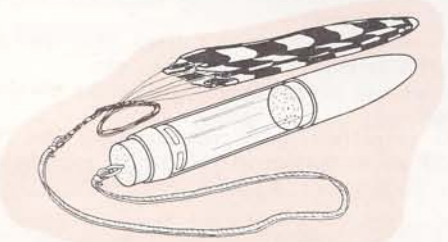
HOMEMADE REAMER

Robert Heil of Rosedale, N.Y. made a reamer using an expired "S" engine casing, a NB-20 nose block, a 6" dowel and a strip of fine sand paper 3/8" x 1 3/4".



Robert uses it for cleaning the engine exhaust deposits and glue out of his tumble and featherweight rockets.

HINT TO ALL SCRAMBLER OWNERS



Tony Medina of Seattle, Wash., suggests using a shock cord between the parachute and the payload compartment of the Scrambler or similar bird.

PAINT CORNER

For easy to make paint designs, Bruce Burger of Syosset, N.Y., uses PRM-1 reinforcing paper cut to wanted design, applied to model, and then painted and removed.

Dennis Shively of Dearborn Heights, Mich., suggests a strip of clear tape on the leading edge of the fins to protect paint and decals.

ESTES INDUSTRIES TECHNICAL NOTE TN-2

MODEL ROCKET ENGINE PERFORMANCE

BY EDWIN D. BROWN, ESTES R&D DEPARTMENT

INTRODUCTION

A model rocket engine is a scientific device. To produce thrust it operates exactly the same way as a "big" rocket. Its solid propellant burns, producing gases, which are expelled through a scientifically designed nozzle. These gases exit at supersonic velocities, producing thrust in the opposite direction (in accordance with Newton's Third Law of Motion).

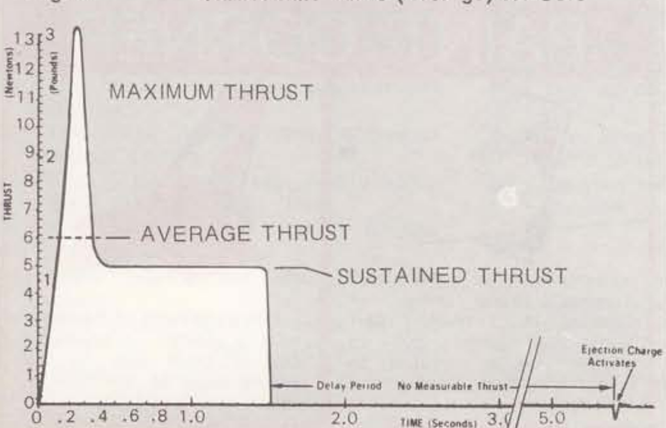
The thrust characteristics of a model rocket engine are measured in the same way, and with the same terminology, as large rocket engines. The total impulse (total power) is measured in pound-seconds or newton-seconds. Suppose a rocket engine produces an average thrust of 1.35 pounds (6 newtons) for 1.5 seconds. This would be total impulse of 2.02 lb.-sec. or 9.0 n.-sec. Looking at the information in the Estes Catalog, you'd find an engine with this much total impulse is a type "C" engine. A time-thrust curve for this type of engine is shown in Figure 1.

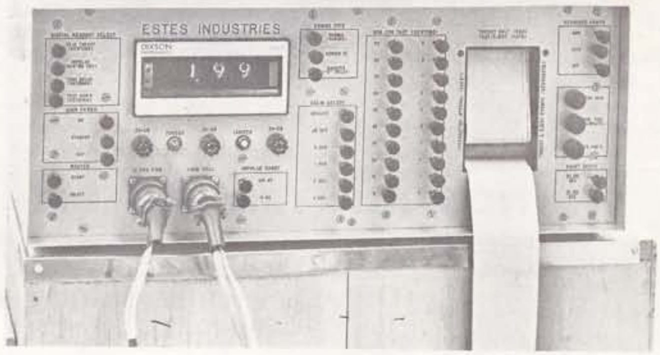
Model rocket engines are also designed to provide other supplementary functions to make the rocket perform satisfactorily. If the rocket engine just produces thrust, then ejects the parachute, you're in trouble. The rocket may be traveling as fast as two or three hundred miles per hour. The wind will literally tear off the shroud lines and/or rip the chute to shreds. Therefore, the model rocket engine is designed with a special slow-burning "delay" material which also produces a dense smoke. This allows you to see your rocket as it coasts upward while slowing down. The ejection charge is initiated after several seconds of coasting flight. This ejects a large volume of gas which rushes into the forward part of the rocket body. The pressure from this gas can be made to push out a parachute, trigger a camera, move an elevator surface, eject the spent engine casing, etc.

All of the above major functions of a model rocket engine are important. Failure of any one part can cause your rocket to not work properly. This is why all Estes engines are carefully tested throughout production. Although the production process is automatic and many tests are done as the engines are made, other supplementary evaluations are continually performed. As the engines come off the machines, three out of every 100 are static tested on an electronic device. Performance information recorded in each of these tests includes peak thrust, average thrust, thrust duration, total impulse, time delay, and the strength of the ejection charge. Tests similar to these are also performed in the field of professional rocketry. The fact that model rockets and professional rockets are so much alike makes the hobby even more exciting and valuable to those who participate.

The following semi-technical description of the model rocket engine and how it works will not only be helpful to you in model rocketry, but will also give you a basic understanding of some important characteristics of all types of solid propellant rockets.

Fig. 1 Thrust-time curve (average) for C6-5





The Estes Semiautomatic Portable Engine Test System (ESPETS) uses 75 solid-state integrated circuits and some 100 transistors. Using the ESPETS' analog and digital readouts, all the major parameters of model rocket engines can be determined and recorded in less than one minute per engine.

THE ENGINE

Choosing the C6-5 type engine as an example, we have the following facts available to us: The C means that the total impulse must be between 1.13 and 2.24 pound-seconds (5.01 and 10.0 newton-seconds); the 6 tells us that the average thrust is 6 newtons (1.35 pounds); and the 5 tells us that there is a 5 second delay after the thrust stops before the ejection charge is ignited. Looking at Figure 2 we see that this engine has the following parts: casing, nozzle, propellant, delay element, ejection charge, and retainer cap. Figure 1 shows a typical thrust-time trace for this engine.

FUNCTIONS OF A TYPICAL ENGINE

The nozzle guides the products of the chemical reaction as they are ejected from the rocket engine.

The propellant is a composite which produces the reaction products by a self-sustaining combustion process. These reaction products allow us to take advantage of Newton's Third Law, "For every action there is an equal and opposing reaction," making our rockets fly.

The delay element is a slow-burning, smoke-producing mixture which allows the rocket to reach its peak altitude before igniting the ejection charge and provides a smoke trail for tracking purposes.

The ejection charge provides a fixed amount of gas which is used to activate the recovery system, etc.

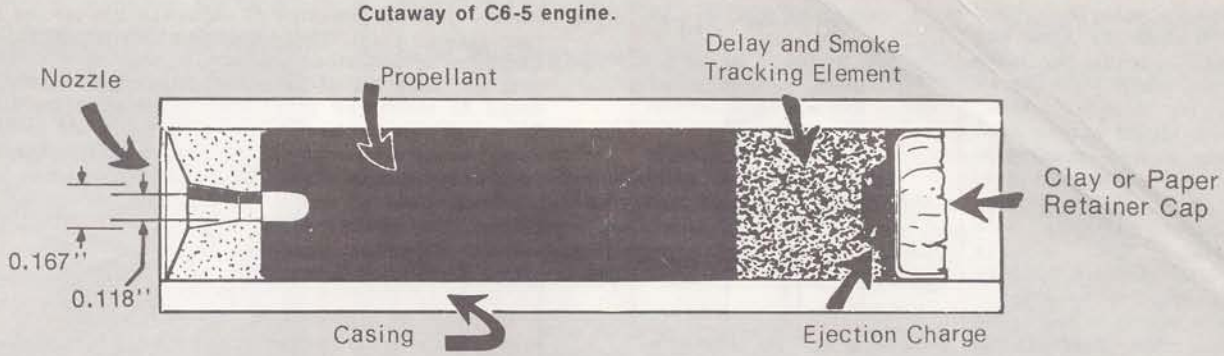
The retainer cap serves only to retain the ejection charge until it is ignited.

Since the propellant, grain configuration, and the nozzle determine the major portion of the engine's performance, we will discuss them further in the next sections.

PROPELLANT CHARACTERISTICS

The important characteristics of a propellant are: burning rate, specific impulse, density, characteristic exhaust velocity, specific heat ratio, temperature of combustion, pressure

Fig. 2 Cutaway of C6-5 engine.



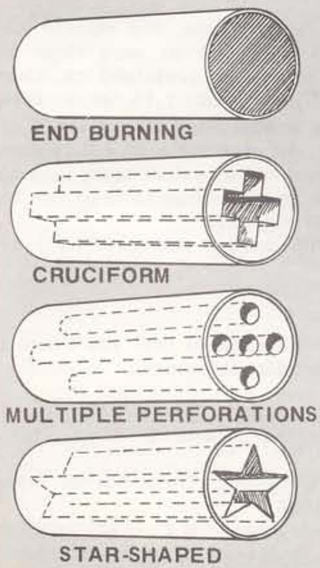
and temperature requirements for ignition, composition of reaction products, resistance to damage due to handling or storage, and possible toxicity.

The most important of these characteristics is its burning rate. The volume of gas that a given propellant can produce in a given time period is limited by the burning rate and the area of the burning surface. This is complicated somewhat by the fact that the burning rate is not a constant. It not only increases as chamber pressure increases, but also increases as the propellant's preignition temperature is raised. It also varies with the propellant composition and the oxidizer particle size within that composition.

Also very important to model rocket performance are propellant density and specific impulse. Generally the more dense (heavy) the propellant is, the less space a given weight of propellant will occupy. Most model rocket propellants are made of a dense material, thus increasing overall efficiency.

Specific impulse is a measurement of propellant efficiency. It is expressed in seconds and is determined by dividing the total impulse of the engine by the weight of the propellant. For example, a C6-5 engine which has a total impulse of 2.25 lb.-sec. and contains 0.028 lb. of propellant will have a specific impulse of 80.36 seconds. Most model rocket engines have specific impulses between 50 and 100 seconds. In professional solid propellant rocketry, where the chamber pressures are higher and more exotic fuels are used, specific impulses of 180 to 250 seconds are common. However, most of these fuels are less dense and require relatively heavy motor casings and rocket frames. Thus, part of the performance increase obtained with the higher energy fuels is lost.

Fig. 3 Typical Grain Shapes



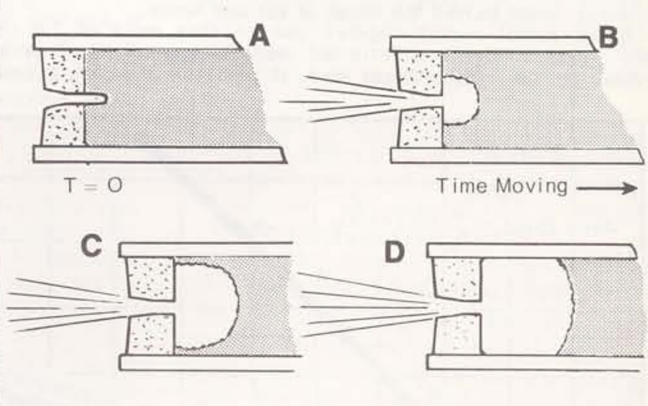
The propellant charge in a solid propellant rocket engine is called the grain. By shaping the grain into different configurations the burning is controlled to obtain desired results. For example, the popular star shape is designed for a constant thrust during the entire burn. Fast burning propellants like those used in model rocketry frequently use a modified end burning grain which is illustrated in Figure 4.

We will not cover the other propellant characteristics in this report because of limited space. However, the serious student may gain more knowledge in these areas by referring to the publications listed at the end of the report.

PROPELLANT GRAIN DESIGN

The primary purpose of varying propellant grain design (grain geometry) is to provide the burning area necessary to produce the desired chamber pressure. The most common grain design found in model rocket engines is a combination of core burning and end burning as shown in Figures 2 and 4. Core burning is also known as progressive burning since the burning area increases with time. End burning is sometimes called neutral burning since the burning area remains constant. The purpose of combining the two types in model rocket engines is to provide a high initial thrust to accelerate the rocket to a high enough speed to stabilize it while it is still being guided by the launch rod and to bring the model up to its maximum speed more or less gradually to minimize drag buildup. (Drag is proportional to the square of the velocity.) Figure 4 illustrates the burning of the propellant in a typical model rocket engine.

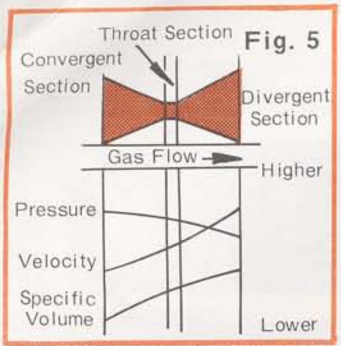
Fig. 4 Transition from core to end burning



Note that in step "C" the engine is approaching a condition of maximum burning surface. As shown in Fig. 1, this produces a peak thrust which occurs about 0.24 seconds after ignition. When the burning has progressed to step "D", the thrust drops to the sustained level.

THE NOZZLE

Most rocket engines use de Laval nozzles. These consist of three separate sections: a convergent section, a throat section, and a divergent section. The convergent section causes the reaction products to increase in velocity in order to pass through the throat section in much the same way that water speeds up when flowing through a narrow part of its channel. (Note: The model rocket engine does not have a true convergent taper in the convergent section.) In the divergent section things become slightly more complicated. The velocity continues to increase because we are exhausting to a lower pressure region and the gaseous reaction products are expanding to this pressure. Figure 5 illustrates what happens to the velocity, pressure, and specific volume (volume occupied by a unit of mass) of gaseous reaction products in a de Laval nozzle.



Once grain design and propellant composition are fixed, then the nozzle and its design become the controlling factors in model rocket engine performance. By varying its design and size, we can vary chamber pressure, specific impulse, thrust level, engine efficiency, etc. The following equations and illustrations show how this happens.

$F = C_F P_c A_t$ eq. 1

$c = I_{sp} g$ eq. 2

$c^* = c/C_F$ eq. 3

$I_{sp} = F/\dot{W}$ eq. 4

F = Thrust (pounds)

C_F = Thrust Coefficient (a dimensionless, relative measure of nozzle efficiency)

P_c = Chamber pressure (pounds per square inch absolute)

A_t = Nozzle throat area (square inches)

c = Effective exhaust velocity (feet per second)

I_{sp} = Specific Impulse (seconds). A measure of propellant efficiency

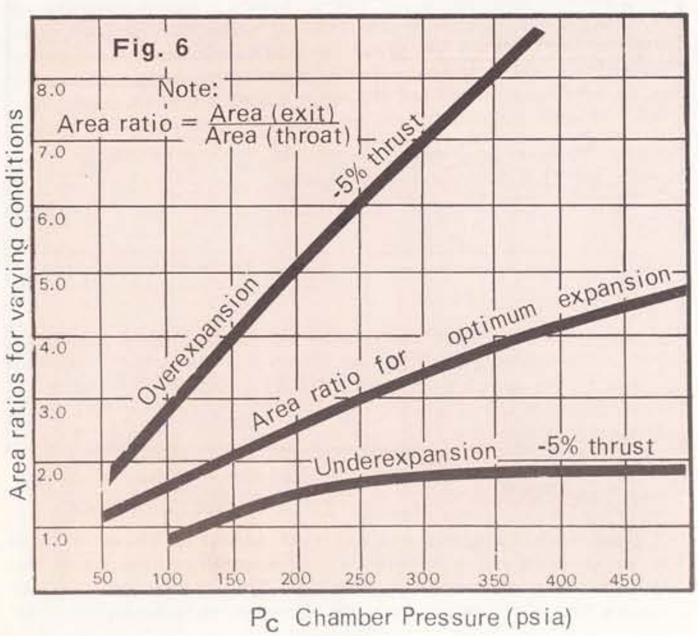
g = Acceleration due to gravity (32.17 feet per second^2)

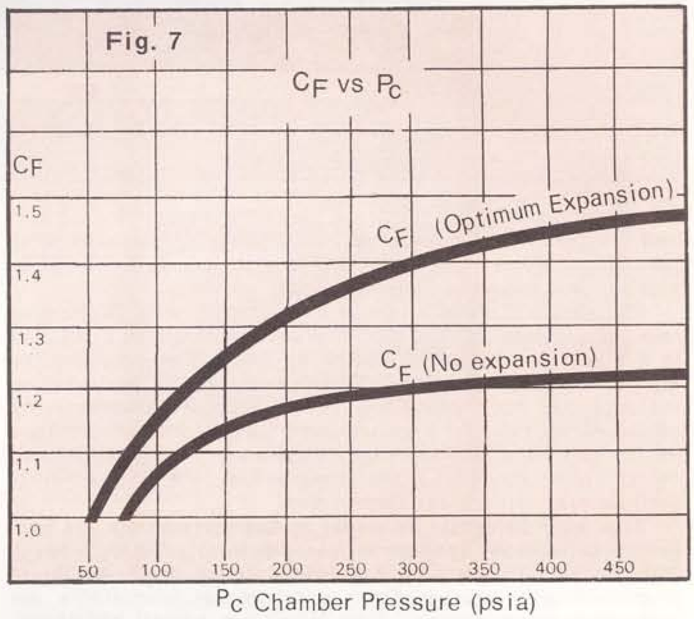
c^* = Characteristic exhaust velocity (feet per second)

$\dot{W}$ = Weight flow rate (pounds per second)

Obviously these equations can be rearranged into many different forms to find the value of various terms.

Estes model rocket engines use an area ratio of 2.0 in their nozzles. By area ratio we mean the nozzle exit area divided by the nozzle throat area. If you look at figure 6 you will see why this area ratio was chosen. At peak thrust we have a chamber pressure of about 225 pounds per square inch, (abbreviated psia). This drops to about 100 pounds per square inch during sustained thrust. With an area ratio of 2.0 we will not lose 5% of potential thrust until chamber pressure drops to around 60 psia. This gives us a good thrust coefficient at both our peak chamber pressure and at our sustained chamber pressure. With an area ratio of 4.0 there would be a loss of more than 5% below a chamber pressure of 150 psia.





The thrust coefficient (C_F) is a function of nozzle efficiency and chamber pressure. Figure 7 illustrates this relationship. As shown, a typical model rocket engine with a peak chamber pressure of 225 psia and a two to one (optimum) expansion ratio, the thrust coefficient will be approximately 1.33. Thus, using equation 1, the peak thrust of this engine can be determined as follows:

$$F = C_F P_c A_t = \frac{1.33}{1} \times \frac{225 \text{ lbs.}}{\text{in.}^2} \times \frac{0.011 \text{ in.}^2}{1} = 3.29 \text{ pounds}$$

Referring to Figure 1 this is approximately the peak thrust shown for the C6-5 Engine.

When the chamber pressure is 225 psia, the nozzle efficiency will be essentially the same for an area ratio of 2.0 or 4.0. However, when we assume a sustained chamber pressure of 100 psia, we get a C_F of about 1.15 for an area ratio of 2.0, which will give us a sustained thrust level of 1.27 pounds. As Figure 6 shows, an area ratio of 4.0 is now over-expanding enough to give us a rather substantial loss of thrust (over 5%). Thus, it is clear an expansion ratio of two to one is ideal for most model rocket engines.

Using equations 2, 3, 4, other useful characteristics of model engines can be derived.

NOTE TO READER

If you have further questions, we suggest that you consult the publications listed below or similar references.

Shapiro, Ascher H. The Dynamics and Thermodynamics of Compressible Fluid Flow. Volumes 1 and 2. New York: Ronald Press, 1953

Sutton, G.P. Rocket Propulsion Elements. Third Edition New York: John Wiley and Sons, Inc., 1963

Williams, F.A., Barrere, M., and Huang, N.C. Fundamental Aspects of Solid Propellant Rockets. Slough, England: Technivision Services, 1969

DANE BOLES JOINS ESTES

Dane Boles, 22, formerly NAR Pacific Division Manager, has joined Estes Industries as Director of the Rocketeer Communications Department. A graduate of the University of Southern California, Dane was Recreation Leader for the Recreation and Parks Department in West Covina, California, as well as Head Recreation Advisor for the West Covina Model Rocket Society. Dane now reports to Robert L. Cannon, executive director of the Communications Division at Estes.

ANSWERS TO PUZZLE

Across

- 2 - Scrambler
- 4 - Omega
- 8 - Avenger
- 9 - Spaceman
- 10 - Mars
- 12 - Aerobee 300
- 14 - Gyroc
- 17 - Space Plane
- 19 - Trident
- 22 - Starlight
- 23 - Streak
- 24 - Alpha
- 25 - Arcas
- 27 - Phantom
- 29 - Nighthawk
- 31 - Mars
- 32 - Midget
- 34 - Cineroc
- 36 - Snooper
- 37 - Little Joe II
- 39 - X-Ray
- 40 - Apogee
- 44 - Thor Agena-B
- 45 - Delta
- 46 - Big Bertha
- 47 - Lander
- 48 - Saturn 1B
- 49 - Honest John
- 50 - Redstone

Down

- 1 - Estes
- 2 - Shrike
- 3 - Birdie
- 5 - Ranger
- 6 - Camroc
- 7 - Beta
- 9 - Starblazer
- 11 - Constellation
- 13 - Orbital Transport
- 15 - Sprite
- 16 - Scout
- 18 - Cobra
- 20 - Skyhook
- 21 - Falcon
- 23 - Sprint
- 26 - Gemini Titan
- 28 - Cherokee-D
- 30 - Wac
- 33 - Drifter
- 35 - Corporal
- 38 - Farside
- 41 - Saturn V
- 42 - Mercury
- 43 - Mark

Careful preparation of your rocket can eliminate "bad luck" in contests

by Larry Renger

Your club is going to have a meet, right? You are going to wipe 'em out with your just built Super-Secret-Gee-Whiz-Mark 7-a, right?

So, Contest Day is here and you are "on-line", count-down, and launch! That surely did wobble going up, better add some nose ballast! Oh, well, you have another attempt, this time you're just a leetle nervous, the hands maybe shake just a bit? Count down, ignition! Ignition? Nobody home! Well, why does bad luck always have to come to contests? Retrieve the rocket and find that the igniter burned, but the motor was not started. "Why me?" you say! Well, maybe you rushed and installed the igniter poorly.

This article is intended to change your "luck". "Bad luck" is a malfunction taking the opportunity you gave it to go wrong.

FIRST: The model. It pays to have a specific model for each event, and duplicates for some! The model for contest work requires your best building ability.

Take your time. Build long before the contest. Sand thoroughly where needed with fine paper. Polish with rubbing compound and wax the finish on high altitude and payload models. For boost glider, spend several different calm evenings hand gliding the glider to achieve minimum sink rate and a smooth wide turn.

Test launch your model and get it trimmed; rockets shouldn't wobble or spin (unless spin stabilized, of course). A boost glider should make the transition to glide almost at the peak altitude.

Then put the model away till contest day! Once it is working right, leave it alone so you won't accidentally damage it. Be sure to pack up your model so it is not resting on its fins. Balsa warps and will ruin all that careful trim.

SECOND: Motor preparation. About a week before "THE DAY", choose the motors to be used in the contest. Install the igniters beforehand if possible. If you are really a perfectionist and live in a damp climate, purchase some silica-gel from your local drug store and put it in a "Baggie" with the engines you plan to use. Silica-gel is a "desiccant" and will absorb the moisture out of the air much more readily than the propellant will. This prevents possible alteration of the thrust the rocket engine can produce.

If the contest is on a very cold day keep your "Baggie" of motors inside your jacket so they will stay near body temperature. Cold motors and damp motors lose impulse.

THIRD: Flying technique. Here is where that testing you did will pay off. By now you should know the flight characteristics of your model thoroughly. On altitude flights tilt the launcher to compensate for wind so that the rocket flies straight up. Pick the chute size for the prevailing wind conditions so you get your model back! A superb flight ending in a lost rocket is a lost contest. A little talcum powder poured between the engine and the wadding helps trackers by giving a nice white puff.

As with cold engines, cold parachutes are a "loser". Plastic gets hard as it cools down, and a cold 'chute can fail to open. For altitude shots use streamer recovery to cut down on drift.

Keep a check list in your field box and go over it the evening before the contest. The next morning all you have to do is pick up your box and rockets and go. Nothing is more frustrating than to get to the field and find you forgot some vital item like glue, tape, scissors, chutes, igniters, motors, launch stand, model, batteries, etc.

Use the shortest launcher that you are sure will give you a stable launch and which the contest director permits for the meet you are attending. A launcher has much more drag than air does.

When it is your turn to fly, be sure to prepare the stand carefully. Clean the micro-clips with sandpaper. Wipe down the launch rail or rod or tower with a silicone-treated rag. The exhaust of previous launches leaves a gritty film which will slow down your bird and tend to rotate it if you launch off a rod or rail. Do not use graphite as a lubricant for the launch rod. When the rod is clean, it may be very lightly oiled or treated with silicone spray or a silicone-treated cloth. Always wipe off all visible films from the launch rod.

When setting your micro-clips onto the igniter, set them so as to have as short an igniter wire as possible. For boost-gliders, be sure that the clips will not hit a part of the glider as they fall free.

In closing, the most powerful secret weapon in your contest arsenal is careful preparation. GOOD LUCK!

January 31 launch

All systems seem to be "Go" for our Apollo 14 astronauts

Do you know how old the Moon is? If you can't answer that question, don't feel bad. Scientists can't either. And that's why at 3:23 p.m. (Eastern Standard Time) on January 31, 1971, three U.S. astronauts are scheduled to lift off from Kennedy Space Center, Florida, aboard an Apollo spacecraft boosted by a Saturn V. They'll be headed for the Moon, over 200,000 miles away, and plan to bring back all sorts of new information that will tell us a great deal more about our nearby natural satellite.

This latest mission in our nation's space program is Apollo 14. It is the sixth United States manned flight to the Moon and the fourth during which men are planning to land there. The first two landing missions, Apollo 11 (Neil Armstrong, Edwin Aldrin, Michael Collins) and Apollo 12 (Charles Conrad, Alan Bean, Richard Gordon) went well, with Neil Armstrong becoming the first man to set foot on the Moon, on July 20, 1969. The third mission, Apollo 13 (Jim Lovell, Jack Swigert, Fred Haise), had the whole world praying while Mission Control successfully brought back the spacecraft which was crippled by an explosion on its way to the Moon.

Commander for the Apollo 14 mission is Alan B. Shepard, Jr., a Navy captain. He is the man who made the first sub-orbital flight aboard Freedom 7, a spacecraft boosted by a Mercury Redstone vehicle, on May 5, 1961, thus starting America on its way to the Moon.

The Command Module pilot is Stuart A. Roosa, a USAF major, and the Lunar Module pilot is Edgar D. Mitchell, a Navy commander.

Apollo 14's landing site on the Moon is the Fra Mauro region, named for a 15th Century Italian monk who was a geographer and mapmaker. Scientists regard the Fra Mauro area (which was also the intended landing site for Apollo 13) as a blanket of debris that may have been tossed up on the surface from depths of 100 miles when Mare Imbrium (the Sea of Rains) was created. The Sea of Rains, in the upper left quarter of the Moon as seen from the Earth, is one of the best known features of the surface.

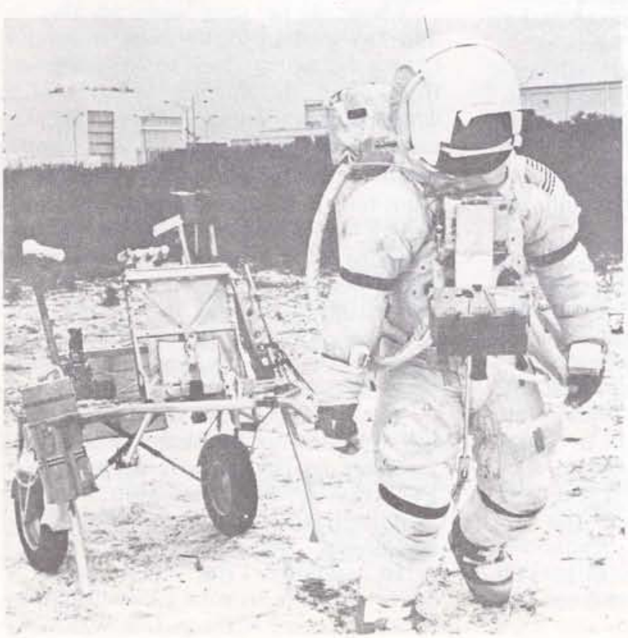
Mitchell and Shepard are the two astronauts who will land on the Moon while Roosa stays in the Command Module in lunar orbit. During their day-and-a-half there they will gather

Apollo 14 astronauts pose in front of their 363-foot tall Saturn V. Left to right: Edgar Mitchell, Alan Shepard, Jr., and Stuart Roosa. NASA Photo

APOLLO 14 PRELIMINARY TIMETABLE

DATE/TIME (EST)

1/31, 3:23 p.m. - Launch
1/31, 5:54 p.m. - Leave Earth orbit on course to intercept Moon
2/1, 9:59 p.m. - Leave free-return trajectory
2/4, 1:58 a.m. - Lunar orbit insertion (57 x 170 nautical miles)
2/4, 6:17 a.m. - Descent orbit insertion of docked spacecraft (10 x 58 nautical miles)
2/4, 11:47 p.m. - Lunar module undocks and separates from spacecraft
2/5, 1:07 a.m. - Command/Service Module circularizes orbit (56 x 63 nautical miles)
2/5, 4:02 a.m. - Lunar module powered descent to lunar surface. (The four hours and fifteen minutes elapsed since undocking and separation were spent making final equipment check).
2/5, 4:14 a.m. - Landing at 3° 40' 19" S. Latitude x 17° 29' 46" W. Longitude. Lunar surface stay time about 34 hours
2/5, 8:50 a.m. - Begin 4- to 5-hour lunar surface activity (EVA)
2/6, 5:30 a.m. - Begin 4- to 5-hour lunar surface activity (EVA)
2/6, 1:44 p.m. - Liftoff of Lunar Module
2/6, 3:30 p.m. - Lunar Module docks with Command/Service Module
2/6, 5:43 p.m. - Lunar Module jettisoned onto lunar surface
2/6, 8:35 p.m. - Apollo 14 departs lunar orbit for Earth
2/9, 4:01 p.m. - Pacific Ocean for recovery by USS New Orleans



During lunar surface simulation training at the Kennedy Space Center, Astronaut Alan B. Shepard, Jr. commander of the Apollo 14 mission, wears an Extravehicular Mobility Unit (EMU) as he pulls the Mobile Equipment Transporter (MET). The MET, nicknamed the "Rickshaw," will serve as a tool carrier and portable work bench for the Apollo 14 moon explorers. (NASA photo.)

rocks at the crest of 400-foot Cone Crater in the Fra Mauro hills. They hope to find rocks that were formed as long as 4.5 billion years ago and then raised to the crest of the crater when it was created by a meteorite crashing on the Moon.

If at all possible, Mitchell and Shepard will try to bring back rocks as big as footballs. This is the size geologists like to have for study because big rocks can tell them more about the minerals that formed them than the small ones.

But there is much more than just picking up rocks. In particular, there is what NASA calls an Active Seismic Experiment during which the Moon will be shaken to help scientists gather new information on the shape, and thickness of the outside lunar crust.

The experiment will be conducted by Mitchell during the first of the four- to five-hour ventures outside the Lunar Module with Shepard. To produce these miniature "moonquakes," Mitchell will set off 21 small explosions on the surface and later will arm a mortar that will launch four grenades after the two astronauts have left. Special equipment will pick up the vibrations caused by the explosions and radio them back to Earth for study by scientists.

While Shepard deploys scientific instruments and gathers rocks, Mitchell will lay out 310 feet of cable and stick three vibration detectors, called geophones, into the moon soil at intervals of 150 feet. Then, as he walks back to a central recording and relay station, he will fire a cartridge every 15 feet with a device called a "thumper." This instrument is a tube about three-and-a-half feet long with a hollow cylinder at the lower end. The upper section contains electronics for the firing mechanism and the cartridge barrel. In the cylinder is a plate which, when pressed against the lunar surface as a cartridge is fired, transmits the force of the explosion to the surface. The vibrations transmitted through the ground are received by the geophones and radioed to Earth.

The high-explosive grenades that will be rocket-launched, on radio command from Earth, after Mitchell and Shepard have left the Moon will also create strong vibrations that will be picked up by the geophones.

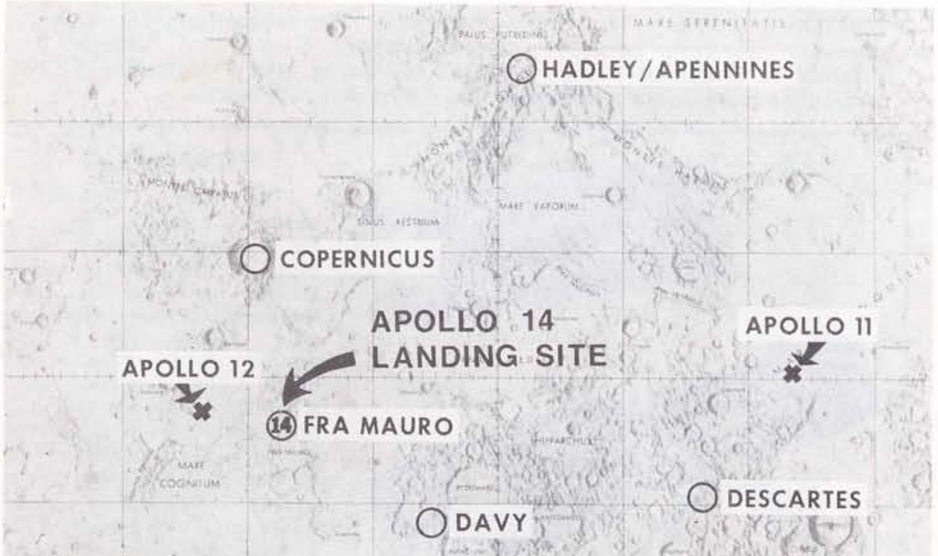
By studying the vibrations, scientists hope to get information from as deep as 1,500 feet. This type of information could help in the search for water on the Moon. Some scientists firmly believe that there might be ice near the surface of the Moon, but that the Sun's heat during the two-week lunar day is not enough to melt that ice. They think that the explosions set off on the Moon could prove their theory. Oil companies use that same method on a larger scale to locate oil-bearing layers in the Earth.

Another unique device introduced by the Apollo 14 astronauts will be the use of a hand-pulled cart that will enable Mitchell and Shepard to walk on the Moon without having to carry heavy equipment on their backs.

Called Mobile Equipment Transporter (MET), the rubber-tired cart weighs 20 pounds when empty and 90 pounds when fully loaded. (It will weigh one-sixth of that on the Moon.) The MET is designed to carry cameras, bags for samples of moon rocks, a device to measure the magnetic field of the Moon, and an assortment of hand tools that includes a shovel, a scoop to pick up samples, and core tubes that are rammed into the ground to get buried materials. There is even a small work table, about the size of a cafeteria food tray, on top.

As of this writing, it looks as if all Apollo 14 systems are "Go" for a successful moon mission. And once again all of us are awaiting that deafening, earth-shaking moment when a Saturn V majestically leaves its launching pad in a fiery lift-off and begins its long journey toward its goal.

Col. Edwin "Buz" Aldrin, second man to walk on the Moon July 20, 1969, holds an Estes Saturn V, a scale reproduction of the rocket that has propelled U.S. moon astronauts into space. Photo was taken at moon rock exhibit during meeting of American Association for the Advancement of Science in Boston, Massachusetts.



The landing site for Apollo 14 is indicated on this NASA map. This point can be located on a moon map (Estes/Damon Science Catalog #15273) or on a moon globe (Estes/Damon Science Catalog #15275).

(Both the Mercury Redstone that boosted Alan Shepard's Freedom 7 during man's first sub-orbital flight and the Saturn V moon rocket are available in kit form from Estes Industries. These two scale models stand 23-1/2" and 43-1/2" tall.)

GODDARD DAY

If you have done your homework, you know that March 16, 1971, will be the 45th anniversary of the birth of modern rocketry. On that day in 1926, at Auburn, Massachusetts, Dr. Robert H. Goddard launched the world's first liquid fuel rocket - one he had designed - and watched it travel 184 feet in 2.5 seconds (that's just a little over 50 M.P.H. or about one-eighth of the speed achieved by most Estes model rockets).

For all of you rocketeers, this should be an important anniversary to observe, and I am sure that you'll want to celebrate Goddard Day in a big way. One of our eastern friends is planning to give the governor of his state an Estes Saturn V he built himself, and he tells us that the governor might declare March 16 "Model Rocketry Day" in the state. This should start you thinking about many other possibilities at the local or state level to honor the memory of the "Father of Modern Rocketry."

D.O.M. WINNERS

Six more first place winners have been selected in the Estes Design of the Month contest. The six, who each received a $50.00 award are:

- April: Craig Francks, Pittsburgh, Pennsylvania, for his "Hummingbird" boost glider.

- May: Ted Nomura, Las Vegas, Nevada, for his "Kamikaze Baka," a replica of a World War II Japanese aerial weapon.

- June: Randy DePuy, Findlay, Ohio, for his "Gyro-Stream" recovery device.

- July (two first-place winners): Ted Nomura, Las Vegas, Nevada, for his Orbital Transport Laboratory (OTL-7A); and John Drabik, Chicago, Illinois, for his telemetry transmitter.

- August: Mark Rupersburg, Sterling Heights, Michigan, for his "Vulcan," a deep space probe type vehicle.

NOTES *continued*

Dear Michael:

I hope everyone who's trying to work on homemade rocket fuels will read your letter twice. Most basement bomber type accidents have now been eliminated through model rocketry, but there are still a few who haven't heard of model rocketry and some who think it won't happen to them. So, we still get a few newspaper clippings about young men losing fingers, eyes, and sometimes even their lives.

Vern

ADVANCED PROJECTS

Dear Vern:

For some reason one of your customers, a classmate of mine, suddenly decided to abandon all forms of rocketry . He says, "there is nothing more to do," and "all model rockets do is go up and come down." I tried to explain the educational aspects of model rocketry, such as designing new models, developing new types of recovery systems, etc., and how through model rocketry it is possible to learn more about math, optics, aerodynamics, photography, etc. I especially like the new CINEROC . . .

Greg M.
California

Dear Greg:

Too bad your classmate doesn't know how much you can actually do with model rockets. There's the new CINEROC which lets you analyze the flight for things like rod whip at launch, staging, trajectory, altitude, and velocity; the CAMROC which was used on an archeology expedition in Egypt; and the new ROCKETRONICS System which lets you hear and record the countdown as it sounds on board the rocket, determine the exact moment of staging, burn out, parachute ejection, or telemeter back spin rate - (or the system can be used to help you locate your rocket stranded in tall weeds or high in a "Rocketus eatumupus.")

Using model rockets, fellows have won everything from science fairs to college scholarships, and it's getting more exciting every day. Now you can even launch your favorite space-loving crickenaut and listen to him "chirp" happily as the rocket arcs over under zero g's; or if you and your friends (or club) get together, perhaps you'll launch a CINEROC and a TRANSROC in the same rocket to produce a sound, color motion picture as the rocket zooms skyward.

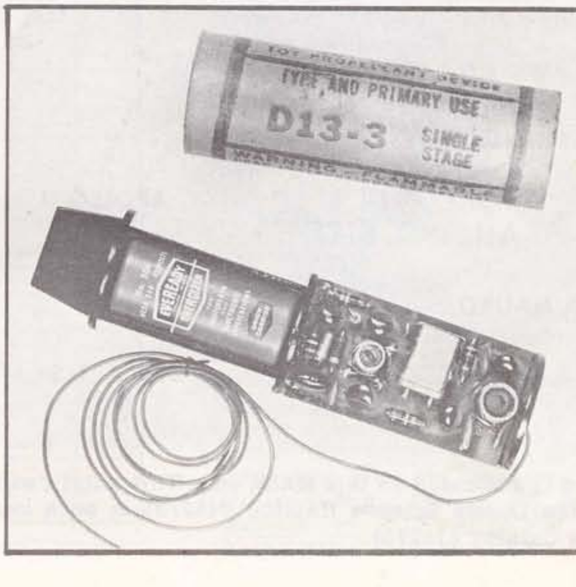
Sure these are advanced projects, but when a fellow says he's done all that can be done in Model Rocketry, I say he's wrong. Now model rocketeers can do almost everything but go to the moon - maybe that's next.

Vern

Well, so long now from the Model Rocket Capital of the world. I've got to get started on my rocket for PROJECT SUPPORT. This time I think I'll use a . . .

Vern

EDITOR'S NOTE: The Estes Rocketeer Communications Department normally answers personal correspondence. Customers' letters are referred to Research & Development, Marketing and/or Vern for review and subsequent action to improve the Estes Space Program.



TRANSROC

The Estes "Transroc" opens up a whole new world for the science-minded rocketeer. It fits neatly into a BT-50 and transmits over distances of more than one mile. Battery life in the beacon mode is over 24 hours. The Transroc uses a trailing wire antenna and broadcasts with 100 mw (milliwatts) on Channel 14 of the 27 Megahertz (megacycle) Citizen Band. This basic unit can be used for providing a rocket-finding beacon and, with the addition of other components, telemetering actual sounds or other data from the rocket.